



FOREWORD

The Level Crossing Removal Authority (LXRA) was established in 2015 by the Victorian Government to oversee one of the largest rail infrastructure projects in the state's history.

Central to the project is the elimination of 50 dangerous and congested level crossings across Melbourne by 2022, and with 12 crossings already removed by January 2018, we've achieved excellent results. In addition to upgrading or building more than 20 train stations, we're laying kilometres of new tracks, improving local travel connections and transforming local community precincts.

Not only are we increasing safety, reducing travel times and congestion for local communities throughout Melbourne, we're also designing our projects with innovation at the forefront.

Our Bayswater project was certified with an independent Infrastructure Sustainability Rating, receiving the highest rating possible and setting a new industry benchmark in sustainable delivery. We've also installed more than 600 solar panels across the new Gardiner, Ormond, McKinnon and Bentleigh train stations, which power key equipment such as ticket machines, lighting and security systems, and offset power usage at other stations along the Frankston Line.

At Edithvale and Bonbeach, we are removing both level crossings using a trench solution, by putting the rail under the road. Undertaking such a significant construction effort in close proximity to the internationally-protected Edithvale-Seafood Wetlands could have an impact on the wetlands, and as a result, the Minister for Planning decided that an Environment Effects Statement (EES) was required to make sure our projects are delivered in such a way as to protect these invaluable environmental assets.

I saw this as a great opportunity for LXRA to work with technical experts and the community to achieve the best possible outcome for the area. The studies and environmental management approach presented in this EES respond to the Scoping Requirements issued by the Minister for Planning. The EES, together with an Inquiry under the *Environment Effects Act 1978* and the final assessment of the environmental effects of the projects by the Minister for Planning, will ensure any possible impacts are identified and managed to keep people and the environment safe.

This EES is the product of a year of hard work from our team at LXRA. We also thank the Department of Environment, Land, Water and Planning and other key stakeholders for their invaluable contribution to the EES process through their involvement on the Technical Reference Group.

I encourage all members of the community to read this EES and make a submission.

Kevin Devlin
CEO LXRA

This page has intentionally been left blank

CONTENTS

SECTION	PAGE
Foreword	i
Contents	iii
Executive Summary	1
Introduction	1
The projects	2
Edithvale level crossing removal project	2
Bonbeach level crossing removal project	3
Benefits of the projects	4
Planning for the Edithvale and Bonbeach level crossing removals	5
Requirement for an EES	5
The EES process	5
Environmental Performance Requirements	6
Potential impacts of the projects	6
Managing impacts	8
Finalising the EES process	9
Glossary and abbreviations	11
Abbreviations	11
Glossary	15

SECTION	PAGE
VOLUME 1	
PART A – INTRODUCTION AND KEY FINDINGS	
1 Introduction	1.1
1.1 Purpose of this document	1.2
1.2 Removal of the Edithvale and Bonbeach level crossings	1.4
1.2.1 Background to the projects	1.4
1.2.2 Objectives of the projects	1.4
1.2.3 Applying the Transport Integration Act	1.5
1.2.4 Developing the projects	1.5
1.3 Edithvale level crossing removal project	1.6
1.3.1 Location	1.6
1.3.2 Project description	1.6
1.4 Bonbeach level crossing removal project	1.6
1.4.1 Location	1.6
1.4.2 Project description	1.9
1.5 Delivering the projects	1.9
1.5.1 Proponent	1.9
1.5.2 Project procurement	1.9
1.5.3 Major Transport Projects Facilitation Act 2009	1.10
1.5.4 Timelines	1.10
1.6 Environment Effects Statement	1.11
1.6.1 Requirement for an EES	1.11
1.6.2 Role of the EES	1.12
1.6.3 EES process	1.12
1.6.4 Consultation	1.12
1.6.5 Scoping requirements and evaluation objectives	1.14
1.7 Project approvals	1.16
1.7.1 Commonwealth approvals	1.16
1.7.2 Victorian approvals	1.16

SECTION			PAGE	SECTION			PAGE
1.8	Environmental compliance	1.17	2.6.5	Surface water management	2.14		
1.9	Approach to the EES	1.17	2.6.6	Groundwater management	2.14		
1.9.1	Environmental impact assessment	1.17	2.6.7	Urban design	2.14		
1.9.2	Environmental Performance Requirements	1.18	2.7	Construction	2.14		
1.9.3	Environmental Management Framework	1.18	2.7.1	Construction activity	2.14		
1.10	EES structure	1.19	2.7.2	Construction hours and workforce	2.17		
2	Rationale and project descriptions	2.1	2.7.3	Construction traffic	2.18		
			2.7.4	Construction work sites	2.18		
			2.7.5	Indicative construction schedule	2.19		
			2.7.6	Waste and spoil management	2.20		
2.1	Introduction	2.2	2.8	Operation and maintenance	2.21		
2.2	Project rationale	2.2	2.9	Addressing sustainability and climate change within project designs	2.22		
2.3	Benefits	2.4	2.9.1	Sustainability	2.22		
2.3.1	Improve transport safety in the Edithvale and Bonbeach areas	2.4	2.9.2	Climate change	2.22		
2.3.2	Reduce traffic congestion in the Edithvale and Bonbeach areas	2.5	3	Key findings	3.1		
2.3.3	Generate local jobs and stimulate the local economy	2.5	3.1	Introduction	3.2		
2.3.4	Facilitate additional train services on the Frankston rail line	2.5	3.1.1	Specialist investigations	3.2		
2.4	Project development	2.6	3.1.2	The structure of this chapter	3.3		
2.4.1	LXRP Business Case	2.6	3.2	Key assets, values and uses	3.3		
2.4.2	Why a rail trench under the road?	2.6	3.3	Potential impacts to regional groundwater	3.4		
2.4.3	Technical design constraints	2.8	3.3.1	Edithvale	3.7		
2.5	Edithvale level crossing removal project	2.8	3.3.2	Bonbeach	3.9		
2.5.1	Rail trench	2.8	3.3.3	Meeting the evaluation objectives	3.10		
2.5.2	Edithvale Railway Station	2.9	3.4	Edithvale-Seaford Wetlands and groundwater dependent ecosystems	3.10		
2.5.3	Railway infrastructure and utilities	2.10	3.4.1	Edithvale-Seaford Wetlands	3.11		
2.5.4	Road, cyclist and pedestrian infrastructure	2.10	3.4.2	Groundwater dependent ecosystems	3.13		
2.5.5	Surface water management	2.10	3.4.3	Native vegetation	3.13		
2.5.6	Groundwater management	2.10	3.4.4	Meeting the evaluation objective	3.14		
2.5.7	Urban design	2.12	3.5	Acid sulfate soils and contamination	3.14		
2.6	Bonbeach level crossing removal project	2.12	3.5.1	Excavation techniques	3.14		
2.6.1	Rail trench	2.12	3.5.2	Acid sulfate soils	3.14		
2.6.2	Bonbeach Railway Station	2.12	3.5.3	Contamination	3.17		
2.6.3	Railway infrastructure and utilities	2.13	3.5.4	Meeting the evaluation objective	3.18		
2.6.4	Road, cyclist and pedestrian infrastructure	2.13					

SECTION	PAGE	SECTION	PAGE		
3.6	Informing the Environmental Management Framework	3.19	5.3	Existing conditions	5.14
3.7	Summary of key findings	3.20	5.3.1	Edithvale-Seafood Wetlands	5.14
4	Assessment Framework	4.1	5.3.2	Aquifers	5.19
4.1	Introduction	4.2	5.3.3	Groundwater levels	5.19
4.2	Objectives	4.2	5.3.4	Groundwater flow	5.19
4.3	Evaluation framework	4.4	5.3.5	Groundwater flow rate	5.21
4.4	EES assessment	4.5	5.3.6	Groundwater recharge and discharge	5.21
4.4.1	Studies responding to draft EES evaluation objectives in Section 4 of the Scoping Requirements	4.7	5.3.7	Groundwater quality	5.21
4.4.2	Studies responding to Section 3.5 of the Scoping Requirements	4.7	5.4	Model results	5.24
4.4.3	Existing conditions	4.7	5.4.1	Edithvale	5.24
4.4.4	Impact assessment	4.8	5.4.2	Bonbeach	5.32
4.4.5	Risk assessment	4.8	5.5	Construction impact assessment	5.34
4.4.6	Environmental management	4.10	5.6	Operation impact assessment	5.35
4.4.7	Integrated assessment	4.11	5.6.1	Edithvale	5.35
4.5	Consultation	4.11	5.6.2	Bonbeach	5.55
4.6	Key approvals	4.11	5.7	Conclusion	5.62
PART B – IMPACT ASSESSMENTS		6	Edithvale-Seafood Wetlands and groundwater dependent ecosystems	6.1	
5	Modelling the water environment	5.1	6.1	Groundwater dependent ecosystems	6.3
5.1	What is groundwater?	5.3	6.2	Groundwater dependent ecosystems and the level crossings	6.4
5.1.1	How groundwater moves	5.3	6.3	Methodology	6.8
5.1.2	Why groundwater levels change	5.5	6.4	Edithvale-Seafood Wetlands	6.9
5.1.3	Groundwater concepts	5.6	6.4.1	Existing conditions	6.9
5.2	Methodology	5.7	6.4.2	Impact assessment	6.11
5.2.1	Task 1: Preliminary assessments	5.8	6.5	Wannarladdin Wetlands	6.15
5.2.2	Task 2: Site investigations	5.8	6.5.1	Existing conditions	6.15
5.2.3	Task 3: Numerical groundwater model development	5.9	6.5.2	Impact assessment	6.18
5.2.4	Task 4: Wetland hydrological model	5.10	6.6	Aspendale to Carrum Foreshore Reserve	6.19
5.2.5	Task 5: Risk and impact assessment	5.11	6.6.1	Existing conditions	6.19
			6.6.2	Impact assessment	6.22
			6.7	Other GDEs within the study area	6.32
			6.7.1	Existing conditions	6.32
			6.7.2	Impact assessment	6.33
			6.8	Conclusion	6.35

SECTION	PAGE	SECTION	PAGE
7 Acid sulfate soils and contamination	7.1	8.6 Surface water	8.31
7.1 What are acid sulfate soils?	7.3	8.6.1 Existing conditions	8.31
7.2 What is contamination?	7.3	8.6.2 Construction impact assessment	8.31
7.3 Methodology	7.4	8.6.3 Operation impact assessment	8.33
7.3.1 Acid sulfate soils	7.4	8.7 Air quality	8.35
7.3.2 Contamination	7.5	8.7.1 Existing conditions	8.35
7.4 Existing conditions	7.6	8.7.2 Construction impact assessment	8.37
7.4.1 Acid sulfate soils	7.6	8.7.3 Operation impact assessment	8.39
7.4.2 Contamination	7.9	8.8 Social	8.41
7.4.3 Spoil generation and assessment	7.19	8.8.1 Existing conditions	8.41
7.4.4 Landfill capacity assessment	7.20	8.8.2 Construction impact assessment	8.42
7.5 Construction impact assessment	7.21	8.8.3 Operation impact assessment	8.44
7.6 Operation impact assessment	7.31	8.9 Business	8.45
7.7 Conclusion	7.39	8.9.1 Existing conditions	8.45
8 Potential local impacts at Edithvale and Bonbeach	8.1	8.9.2 Construction impact assessment	8.46
8.1 Introduction	8.2	8.9.3 Operation impact assessment	8.48
8.2 Noise and vibration	8.3	8.10 Landscape and visual	8.49
8.2.1 Existing conditions	8.4	8.10.1 Existing conditions	8.49
8.2.2 Construction impact assessment	8.6	8.10.2 Construction impact assessment	8.53
8.2.3 Operation impact assessment	8.10	8.10.3 Operation impact assessment	8.54
8.3 Traffic	8.14	8.11 Ecology	8.59
8.3.1 Existing conditions	8.14	8.11.1 Existing conditions	8.59
8.3.2 Construction impact assessment	8.17	8.11.2 Construction impact assessment	8.62
8.3.3 Operation impact assessment	8.23	8.12 Land use	8.67
8.4 Historic heritage	8.24	8.12.1 Existing conditions	8.67
8.4.1 Existing conditions	8.25	8.12.2 Construction impact assessment	8.67
8.4.2 Construction impact assessment	8.28	8.12.3 Operation impact assessment	8.69
8.4.3 Operation impact assessment	8.28	PART C – MANAGING DELIVERY	
8.5 Aboriginal cultural heritage	8.29	9 Environmental Management Framework	9.1
8.5.1 Existing conditions	8.29	9.1 Scoping Requirements	9.2
8.5.2 Construction impact assessment	8.29	9.2 Statutory context	9.3
		9.3 Purpose of the EMF	9.3
		9.4 Projects overview and description	9.4

SECTION	PAGE	SECTION	PAGE
9.5	Contract structure	9.4	
9.6	Governance framework	9.5	
9.7	Roles and responsibilities	9.6	
9.8	Environmental management plans and documentation	9.8	
9.8.1	Overview	9.8	
9.8.2	Managing groundwater impacts	9.9	
9.8.3	Process for developing key plans	9.11	
9.8.4	Approvals and change management	9.13	
9.8.5	Contingency measures	9.14	
9.8.6	Consultation	9.15	
9.9	Evaluating environmental performance	9.16	
9.9.1	Monitoring	9.16	
9.9.2	Reporting	9.16	
9.9.3	Peer review	9.16	
9.9.4	Auditing	9.17	
9.10	Environmental performance requirements	9.17	
9.10.1	Context	9.17	
9.10.2	Consultation required by the EPRs	9.18	
9.10.3	Risk assessment	9.18	
10	Sustainability and climate change	10.1	
10.1	Introduction	10.2	
10.2	Sustainability and the Environment Effects Statement	10.2	
10.3	Sustainability legislative context	10.3	
10.4	What is sustainability?	10.5	
10.5	LXRA's sustainability framework	10.6	
10.5.1	Sustainability strategy	10.6	
10.5.2	LXRA's sustainability policy	10.7	
10.5.3	LXRA's program climate change risk assessment framework	10.7	
10.5.4	Sustainability rating tools	10.7	
10.5.5	Sustainability outcomes	10.9	
10.6	Integrating climate change in the impact assessment process	10.11	
10.6.1	Uncertainty in climate change scenarios	10.11	
10.6.2	Climate change in groundwater impact assessment	10.11	
10.6.3	Climate change in surface water impact assessment	10.12	
10.7	Sustainability knowledge sharing	10.12	
11	Urban design approach	11.1	
11.1	Introduction	11.2	
11.2	Urban design and the Environment Effects Statement	11.2	
11.3	LXRA's approach to urban design	11.3	
11.3.1	Urban Design Framework	11.4	
11.3.2	Urban Design Guidelines	11.5	
11.3.3	Urban Design Advisory Panel	11.7	
11.4	Edithvale and Bonbeach Urban Design Guidelines	11.7	
11.4.1	Developing the Urban Design Guidelines	11.8	
11.5	Design Guidelines	11.11	
11.5.1	Identity and urban integration	11.11	
11.5.2	Connectivity, wayfinding and accessibility	11.12	
11.5.3	Amenity and safety	11.13	
11.5.4	Vibrancy	11.14	
11.5.5	Resilience and sustainability	11.15	
11.6	Conclusion	11.16	
12	Community and Stakeholder Engagement	12.1	
12.1	Introduction	12.2	
12.2	Consultation framework	12.2	
12.3	Engagement principles	12.4	
12.4	Engagement objectives	12.5	

SECTION	PAGE	SECTION	PAGE
12.5 Overview of engagement	12.6	VOLUME 3	
12.5.1 Early investigations	12.6	Technical Report C: Acid Sulfate Soils and Contamination	
12.5.2 Options assessment	12.8	Technical Report D: Ecology: Project Areas	
12.5.3 Design development	12.10	Technical Report E: Surface Water	
12.5.4 Preliminary design	12.12	Technical Report F: Land Use	
12.5.5 Project delivery	12.12	Technical Report G: Traffic	
12.6 Consultation activities and tools	12.12	Technical Report H: Noise and Vibration	
12.6.1 Print communications	12.12	VOLUME 4	
12.6.2 Digital communications	12.13	Technical Report I: Air Quality	
12.6.3 Engagement	12.13	Technical Report J: Landscape and Visual	
12.6.4 Hard to reach	12.13	Technical Report K: Business	
12.7 Stakeholders	12.14	Technical Report L: Social	
12.7.1 Approvers and Government	12.14	Technical Report M: Aboriginal Cultural Heritage	
12.7.2 Community and stakeholders	12.14	Technical Report N: Historic Heritage	
12.8 Feedback received through engagement	12.15	VOLUME 5	
12.9 Response to feedback	12.16	Attachment VI: Map book	
12.10 Ongoing engagement	12.19	Attachment VII: Urban Design Guidelines –Edithvale	
Attachment I: Legislation and Policy Report		Attachment VIII: Urban Design Guidelines –Bonbeach	
Attachment II: Environmental Risk Report			
Attachment III: Matters of National Environmental Significance and Wannarladdin Wetlands			
Attachment IV: LXRA corporate policies			
Attachment V: Draft Planning Scheme Amendments			
VOLUME 2			
Technical Report A: Groundwater			
Technical Report B: Ecology: Wetlands and Groundwater Dependent Ecosystems			



EXECUTIVE SUMMARY

Introduction

The Victorian Government is removing 50 of Victoria's most dangerous and congested level crossings, including the crossings at Edithvale Road, Edithvale (Edithvale) and Station Street/Bondi Road, Bonbeach (Bonbeach) on the Frankston rail line.

The Frankston rail line serves some of Melbourne's most vital economic centres, as well as vast and growing residential catchments. The corridor currently serves a population of around 250,000 people, which is forecast to grow to around 500,000 people by 2036. It also provides access to the significant industrial precinct and transport gateway at the Port of Hastings, and a key metropolitan activity centre at Frankston. The Frankston Hospital and Monash University campus in Frankston are significant regional employers.

In February 2017, the Victorian Government announced that the level crossings at Edithvale and Bonbeach would be removed by lowering the rail into a trench at each location. New stations would also be built at Edithvale and Bonbeach as part of each project.

On 5 April 2017, the Minister for Planning requested that LXRA prepare an Environment Effects Statement (EES) under the *Environment Effects Act 1978* (EE Act) to assess the potential environmental effects of the projects.

In addition, the Commonwealth Minister for the Environment and Energy determined that the level crossing removal projects at Edithvale and Bonbeach require approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), due to the potential cumulative impact on the internationally-important Edithvale-Seaford Wetlands, listed threatened species and migratory species. This EES also considers the matters of national environmental significance for assessment under that Act.

Investigations conducted for the EES have found that the level crossing works would not directly impact the wetlands. Any other potential impacts are minor and can be managed effectively through the environmental processes.

The projects would be delivered through an Alliance model in which a construction partner works alongside LXRA and Metro Trains Melbourne (MTM) to prepare detailed designs and construct the project, with construction planned to commence in 2019. The level crossing would be removed by 2022.

Once the construction is complete, LXRA would return the finished rail infrastructure to VicTrack, the Victorian Government body which owns Victoria's transport land, assets and infrastructure. Rail operations would be conducted by MTM which would operate the rail line.

Level Crossing Removal Authority

The Level Crossing Removal Authority (LXRA) is an administrative office of the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) and is one of several Victorian Government agencies delivering its integrated transport policy objectives.

LXRA is responsible for the delivery of the 50 level crossing removals, including the level crossings at Edithvale and Bonbeach, for the Victorian Government.

Specifically, LXRA is responsible for:

- developing the design of the level crossing removal projects
- coordinating technical investigations
- preparing this EES
- engaging and informing stakeholders and the wider community
- obtaining the key planning and environmental approvals
- coordinating procurement activities to appoint a private sector construction partner
- delivering the projects as a member of the construction Alliance
- coordinating the commissioning of the new infrastructure.

The projects

Edithvale level crossing removal project

Location

The level crossing at Edithvale Road is located south of the existing Edithvale Station between Nepean Highway and Station Street. It is approximately 32 kilometres from Flinders Street Station. Edithvale Road runs in an east-west direction between the Nepean Highway and Wells Road, and is a declared arterial road linking Edithvale and surrounding suburbs to the Nepean Highway, the Mornington Peninsula Freeway (M11) and to Melbourne's eastern suburbs via Springvale Road, Eastlink and Westall Road.

The Edithvale project area is located predominantly within the existing rail reserve owned by VicTrack. The rail reserve was established in the early 1880s and has been disturbed by more than a century of rail-related activities.

The Edithvale project area extends from Lincoln Parade, Aspendale to Chelsea Road, Chelsea. It includes the rail corridor and all of Station Street and Nepean Highway to the east and west, and small sections of adjacent road reserves.

Existing pedestrian and cyclist crossings in proximity to the level crossing are located at Lochiel Avenue, Edithvale Road, Denman Avenue, Fraser Avenue and Berry Avenue. No private land would be required for the project.

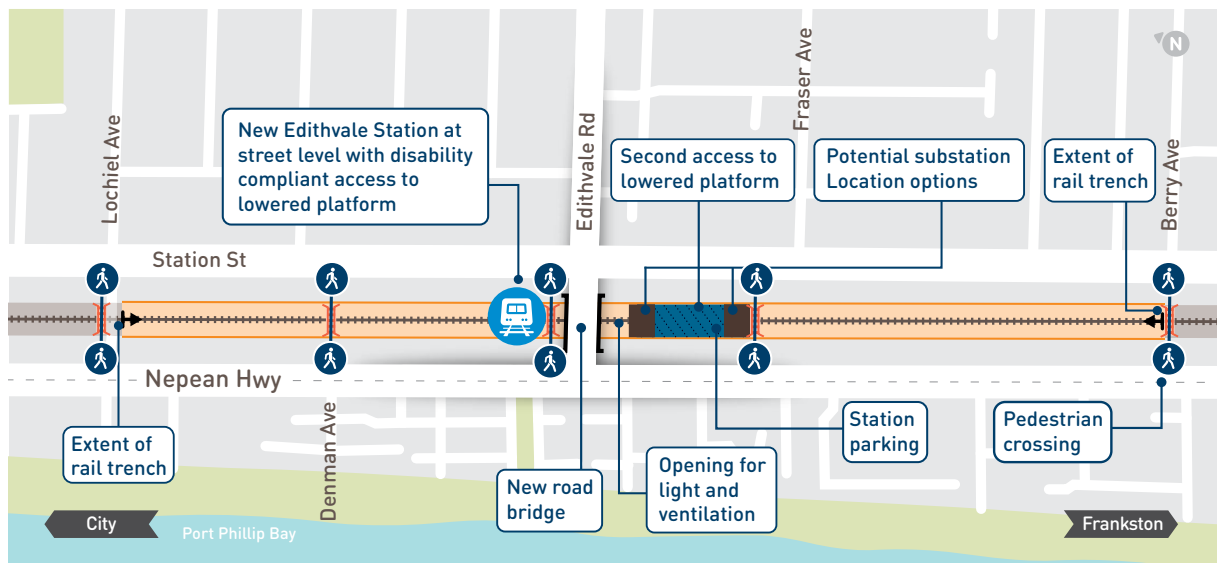
Project description

The Edithvale project involves removing the level crossing by lowering the Frankston rail line into a trench under Edithvale Road while maintaining Edithvale Road at the current road level.

The trench would be constructed between Lochiel Avenue and Berry Avenue. It would be up to 1,300 metres in length, 14 metres wide at the narrowest point, widening up to 24 metres at the new Edithvale Station. The rail track would be approximately eight metres below ground level at its lowest point at Edithvale Station and therefore the maximum depth of excavation would be 14 metres to allow for underground infrastructure (below the rail track) to collect and divert rain water from the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would be required to provide for the new station building, car parking and a substation required to ensure sufficient power is available for passenger services on the Frankston rail line. New pedestrian bridges would be constructed to retain pedestrian access across the rail line. A new station at the same location as the existing station would be constructed with disability compliant access to the below-ground train platforms. Project components are shown schematically in Figure A.

Figure A Schematic design for Edithvale



Bonbeach level crossing removal project

Location

The level crossing at Station Street/Bondi Road is located south of the Bonbeach Station between Nepean Highway and Station Street. It is approximately 35 kilometres from Flinders Street Station.

The Bonbeach project area is located predominantly within the existing rail reserve owned by VicTrack. The rail reserve was established in the early 1880s and has been disturbed by more than a century of rail-related activities.

The Bonbeach project area extends from Chelsea Road, Chelsea to Patterson River, Bonbeach. It includes the rail corridor and all of Station Street and Nepean Highway located to the east and west, and small sections of adjacent road reserves.

Existing pedestrian and cyclist crossings across the rail corridor are located at Golden Avenue, Wellwood Road, Bondi Road and The Glade.

No private land would be required for the project.

Project description

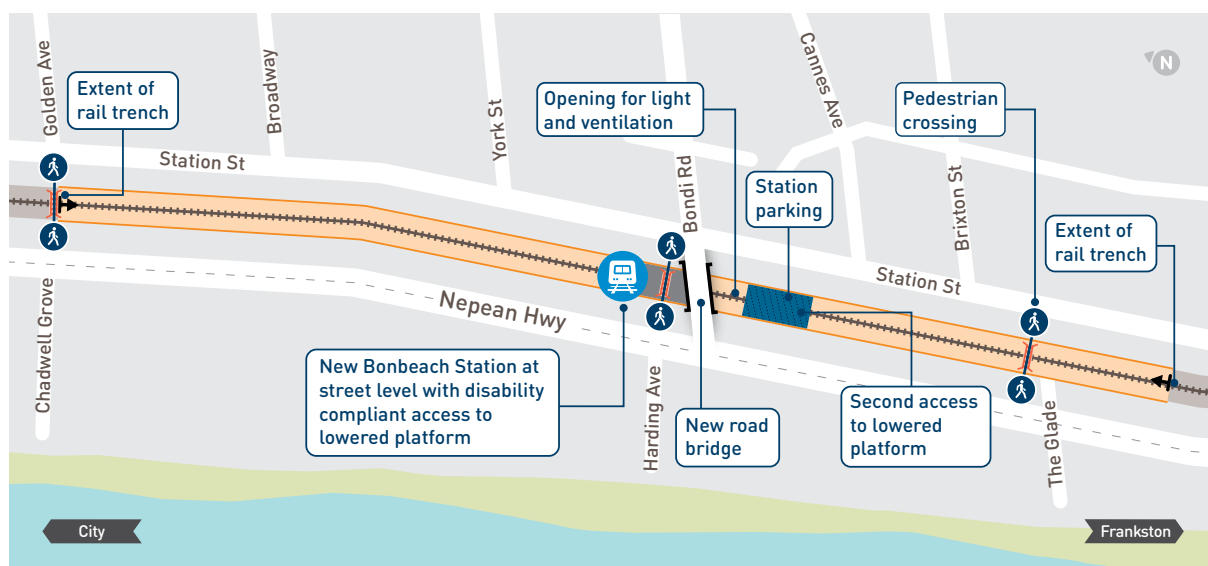
The Bonbeach project involves removing the level crossing by lowering the Frankston rail line into a trench under Bondi Road while maintaining Bondi Road at the current road level.

The trench would be constructed between Golden Avenue and The Glade. It would be up to 1,200 metres in length and 14 metres wide at its narrowest point, widening up to 24 metres at the new Bonbeach Station platforms. The rail track would be approximately eight metres below ground level at its lowest point at Bonbeach Station and therefore the maximum depth of excavation would be 14 metres to allow for underground infrastructure (below the rail track) to collect and divert rain water from the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would provide for the new station building and car parking. New pedestrian bridges would be constructed to retain pedestrian access across the rail line. A new station at the same location as the existing station would be constructed with disability compliant access to the below-ground train platforms.

Project components are shown schematically in Figure B.

Figure B Schematic design for Bonbeach



Benefits of the projects

The Edithvale and Bonbeach level crossing removal projects are part of the Victorian Government's Level Crossings Removal Program (LXRP). The objectives of the program, which are consistent with the objectives of the *Transport Integration Act 2010* (TI Act), are to:

- deliver significant safety improvements for drivers, cyclists and pedestrians
- improve travel around the local areas – for train users, pedestrians, cyclists and drivers
- get people home safer and faster
- make our roads more reliable, enabling people to better predict their travel times
- stimulate economic growth by creating jobs during construction
- revitalise local communities, including modernisation of station precincts
- enable more trains to run more often and on time.

Each level crossing removal project contributes to the objectives of the overall LXRP.

The program also includes the Metropolitan Network Modernisation Program improvements (including new train stations, improved public transport access, and new pedestrian and cycling links) and amenity improvements such as landscaping and streetscape improvements.

Within this broader context, the specific objectives of the Edithvale and Bonbeach level crossing removal projects are to:

- improve transport safety in the Edithvale and Bonbeach areas
- reduce traffic congestion in the Edithvale and Bonbeach areas
- generate local jobs and stimulate the local economy
- facilitate additional train services on the Frankston rail line.

The projects also include significant upgrades to the existing Edithvale and Bonbeach stations, which are reaching the end of their intended design life, as well as improvements to public areas around the stations.

The benefits of the removal of the Edithvale and Bonbeach level crossings align with the projects' objectives through:

- eliminating the risk of collision between trains and vehicles, cyclists and pedestrians
- improving amenity at Edithvale and Bonbeach stations, contributing to improved transport safety
- eliminating the traffic delays associated with the level crossings for to the 14,000 vehicles that use the Edithvale level crossing and the 4,500 vehicles that use the Bonbeach level crossing each weekday
- generating hundreds of jobs within the local areas for the duration of the construction program
- facilitating more train services on the Frankston line.

Planning for the Edithvale and Bonbeach level crossing removals

The Edithvale and Bonbeach level crossing removal projects are being assessed under the EE Act, which provides for the assessment of proposed projects in Victoria that could have a significant effect on the environment.

Requirement for an EES

On 5 April 2017, the Minister for Planning determined that an EES was required to inform the Minister's assessment of the potential environmental effects of the projects and the approvals required.

The Minister's reasons for making this decision included that the project works have '*the potential for a range of significant environmental effects*'. In particular, the project would potentially examine effects on:

- The regional groundwater regime resulting in potential changes to hydrological conditions at the Ramsar listed Edithvale-Seaford Wetlands.
- The ecological character and habitat values of the Edithvale-Seaford Wetlands, and the dependent flora and fauna, in particular the critical components of habitat for listed waterbirds, due to alterations in the groundwater regime.
- The protected beneficial uses of groundwater, due to alterations in the groundwater regime, along with risks to human health, recreation and ecosystems due to changes in water quality.

The Minister's decision determined that 'other potential effects on the social or environmental setting are unlikely to be significant and should be readily addressed and mitigated through existing statutory processes' including under the *Environment Protection Act 1970* and *Planning and Environment Act 1987*.

The matters to be investigated and documented in the Edithvale and Bonbeach Level Crossing Removal Project's EES are set out in the 'Scoping Requirements' issued by the Minister in September 2017. These requirements reflect the decision of the Minister for Planning on the need for an EES and identify key issues related to how the trenches could impact on regional groundwater movements and what effect this could have on the Edithvale-Seaford Wetlands, and how the trenches could expose pre-existing contamination and potential acid sulfate soils and possibly affect human health, recreation and ecosystems.

The EES process

An EES is not an approval process. An EES assessment demonstrates the ability of the projects to meet statutory requirements. It provides decision-makers (including Ministers and other statutory authorities) with the information they need to make decisions about whether statutory approvals for the project should be granted and, if so, what conditions should apply.

This EES:

- describes the proposed Edithvale and Bonbeach level crossing removal projects
- describes the existing environment that may be affected by the projects
- identifies the potential effects of the projects on the environment
- recommends ways to avoid, minimise, offset or manage any adverse effects
- proposes an environmental management framework for managing and monitoring potential environmental effects during implementation of the projects.

The EES process is designed to be rigorous and transparent, with opportunities provided for input from stakeholders and the wider community. It includes environmental impact assessments undertaken by 14 technical specialists to ensure the EES addresses the Scoping Requirements set by the Minister for Planning.

The Victorian Government's EES process is accredited to assess impacts on Matters of National Environmental Significance (MNES) under the EPBC Act through the Bilateral (Assessment) Agreement between the Commonwealth and the State of Victoria. This EES therefore also considers Matters of National Environmental Significance.

Environmental Performance Requirements

One of the key outcomes of the EES process is to recommend a set of Environmental Performance Requirements (EPRs). The EPRs define the environmental outcomes that must be achieved during design, construction and operation of the Edithvale and Bonbeach level crossing removal projects regardless of the detailed design solutions adopted. They may also represent the measures developed in this EES to avoid, reduce or offset potential environmental impacts. These measures are not necessarily the only or 'best' means of managing impacts. They are provided as examples to demonstrate that practicable measures are available to achieve the EPR. Under the performance-based approach being adopted for the projects, it would be up to the Alliance to determine how best to achieve the EPRs. The implementation of the Environmental Management Framework (EMF) will provide oversight of the Alliance's achievement of the EPRs.

The 14 technical specialists developed an initial set of EPRs as part of their impact assessments. These assessments evaluated the environmental effects of the projects and the proposed construction methodologies. Through the risk assessment process, the initial set of EPRs was refined to a final set of EPRs that reflect the findings of the impact assessment and the designs.

The approach adopted to develop and refine the EPRs and assess environmental risks and impacts is described in Chapter 4 *Assessment framework*. A full list of the EPRs for the project is set out in Chapter 9 *Environmental Management Framework*.

Potential impacts of the projects

The projects would remove two dangerous and congested level crossings, and contribute to significant improvements in the capacity, efficiency and reliability of the Frankston rail line, and create safer and more vibrant precincts for the two suburbs.

Like all infrastructure projects, their construction and operation would change the local setting and potentially affect the local environment, particularly during construction. The construction activity would be disruptive, particularly to those who live adjacent to the works. However, the disruption would be temporary during which time LXRA would work closely with those affected to ensure a high level of communication is maintained throughout the construction period which would ultimately deliver a high quality urban outcome that creates a much safer environment for residents of, and visitors to, both Edithvale and Bonbeach.

The investigations undertaken for the EES focused primarily on the three potentially significant impacts identified by the Minister for Planning in determining the requirement for an EES. An additional 11 investigations were undertaken to assess potential impacts of each project on all aspects of the environment. This section presents the key findings of those investigations.

The Seaford component of the Edithvale-Seaford Wetlands is over five kilometres from the projects and is separated by Patterson River and Patterson Lakes. These features provide a hydrogeological barrier such that any changes to the regional groundwater regime due to the projects could not affect the Seaford Wetland. The initial groundwater model prepared for the EES predicted that the trench proposed at Edithvale would result in groundwater mounding on the inland side that could potentially increase the frequency of water logging that already occurs on occasion in the Edithvale area. The same impact was not identified at Bonbeach.

In response to the risk of water logging, activation of acid sulfate soils and a potential increase in the salinity of groundwater, an engineering solution was developed to enable groundwater to flow around the trench structure at Edithvale and reduce the potential mounding to within natural variability. The engineering solution was then tested using the groundwater model to confirm it would be effective to reduce groundwater mounding so that it would not result in water logging beyond existing levels and extents.

Groundwater drawdown between the trenches and the coast may affect a small area of coastal vegetation and pre-existing naturally occurring acid sulfate soils, but through implementing the EPRs, beneficial uses of groundwater would not be impacted.

Table A provides a summary of the key findings.

On balance, and in considering these findings, LXRA considers that the three evaluation objectives established by the Scoping Requirements have been met.

Table A Summary of key findings

Topic	Key finding
1. Potential impacts to regional groundwater	<p>The proposed trench at Edithvale has the potential to exacerbate existing water logging as a result of groundwater intersecting with the surface. The project would be designed to avoid this impact and ensure no significant impacts to the environment occur. An engineering solution has been developed and modelled using the independently peer reviewed groundwater model prepared for the EES to demonstrate this outcome is achievable. These potential changes to groundwater have been assessed as minor.</p> <p>Groundwater flows in a different direction at Bonbeach compared to Edithvale and mounding is not predicted to cause water logging at this project.</p>
2. Edithvale Wetland	<p>Given the distances between the Edithvale Wetland and the project sites (1.3 kilometres from the existing Edithvale Road level crossing and two kilometres from Bonbeach level crossing), the works would not directly impact the wetlands through, for example, loss of vegetation or disturbance to bird species.</p> <p>Furthermore, the groundwater modelling predicts that the effect of the trenches on regional groundwater would return to background levels at least one kilometre from the wetlands, such that the hydrological regime and ecological character of the wetlands would not be affected. The Edithvale-Seaford Wetlands would therefore continue to meet the applicable Ramsar listing criteria.</p>
3. Groundwater Dependent Ecosystems (GDEs)	<p>Terrestrial GDEs exist in a naturally variable environment in which water is accessed via the surface or groundwater. Both sources naturally fluctuate based on long-term climatic conditions and the prevailing weather and as such terrestrial GDEs must be adaptable and resilient to these variable conditions. Given the small change in groundwater predicted through the model it is likely changes to vegetation will be minor or negligible.</p>
4. Native vegetation	<p>Native vegetation is present within the rail corridor and would be removed to enable construction of the proposed rail trenches. Conservatively assuming that both project areas would be cleared of all vegetation, the area of affected native vegetation would total 2.2 hectares. This would be substantially minimised in finalising project designs and construction methodologies, clearing only what is necessary, and offsetting the impacted vegetation in accordance with Victorian Government policy.</p>
5. Acid sulfate soils and contamination	<p>The projects would prevent adverse environmental or health effects from disturbing, storing or influencing the movement of contaminated or acid-forming material, and be designed to protect beneficial uses. Excavation of material that is likely to be contaminated would be unavoidable, however implementation of well-defined and established practices to manage environmental and human health risks would be implemented. The overall risk is minor.</p>
6. Construction impacts	<p>Construction would result in localised amenity impacts related to noise and transport network disruption, but can be managed effectively using well established practices.</p> <p>The potential impacts to the community during the construction of the two projects are typical of any construction project.</p> <p>Comprehensive environmental and traffic management plans would be implemented to ensure legislative and policy requirements are met, and an extensive program of community and stakeholder consultation would be undertaken prior to and during construction to ensure that the community, particularly residents and businesses that may potentially be directly affected, are aware of upcoming works and are able to plan their activities.</p>

Topic	Key finding
7. Noise during operations	Noise modelling confirms that the projects would not exceed the investigation thresholds in the Passenger Rail Infrastructure Noise Policy.
8. Visual amenity	<p>The areas surrounding the projects are highly valued for their coastal setting. The projects would change the visual appearance of the transport corridor through Edithvale and Bonbeach by replacing the existing at-grade rail infrastructure with a modern station building and precinct, car parking on deck, footbridges, safety barriers along the trench and a substation at Edithvale. Although vegetation would be lost, new landscaping would be established.</p> <p>The urban design of the projects would be guided by a comprehensive set of Urban Design Guidelines.</p>

Managing impacts

The Edithvale and Bonbeach level crossing removal projects would be designed, constructed and maintained in accordance with an EMF, included as Chapter 9 of this EES. The EMF provides a transparent and integrated governance framework to manage the potential environmental effects of the Edithvale and Bonbeach level crossing removal projects identified in this EES. It responds to Section 3.5 of the Scoping Requirements issued for the EES, as well as the need to ensure a high level of rigour within the environmental management of both projects.

The objectives of the EMF are to:

- establish a framework to ensure compliance with statutory requirements and minimise environmental risks
- set out the environmental outcomes to be achieved during design and construction and encourage innovation to achieve them
- ensure accountabilities are identified for managing and monitoring environmental effects and hazards associated with the design and construction phases of the projects.

The EMF outlines clear accountabilities for the delivery and monitoring of the implementation of the projects and includes a set of EPRs. The EPRs determine the environmental outcomes that the design and construction of the Edithvale and Bonbeach projects must achieve.

The EMF requires the contractor constructing the projects to implement an Environmental Management System (EMS) certified to AS/NZS ISO 14001:2016 *Environmental management systems – Requirements with guidance* and to comply with relevant legislation, policy and guidelines.

The purpose of the requirement for an EMS is to ensure that works are planned and performed so that the adverse effects on the environment are either avoided, minimised or managed, and are carried out in accordance with the EPRs. The EMF requires the contractor to specifically apply its EMS, and modify it if required for the delivery of works for the projects.

The EMF provides a structured approach for monitoring the implementation of the Construction Environment Management Plan (CEMP) and other plans required to comply with the EPRs, the Incorporated Documents and any statutory approvals.

Finalising the EES process

The EES will be on public exhibition for 30 business days. During this time, the public can read the EES and make written submissions about matters presented within it. Submissions can also be made on the draft planning scheme amendments being exhibited at the same time (see Attachment IV *Draft Planning Scheme Amendment*).

At the end of the public exhibition period, an independent inquiry will consider the effects of the Edithvale and Bonbeach level crossing removal projects, having regard to the EES, the proposed planning scheme amendments and public submissions and provide a report to the Minister for Planning. Following receipt of the inquiry's report, the Minister for Planning will consider the report and issue a written assessment of the projects. This document, called the 'Minister's Assessment', will inform statutory decision-makers responsible for issuing environmental approvals for the projects.

Three main approvals are required:

- Commonwealth approval under the EPBC Act
- Planning Scheme Amendment under the *Planning and Environment Act 1987*
- Cultural Heritage Management Plan (CHMP) under the *Aboriginal Heritage Act 2006*.



This page has intentionally been left blank



GLOSSARY AND ABBREVIATIONS

Abbreviations

Term	Definition
AAQ	Ambient Air Quality
AV	Aboriginal Victoria
ANC	Acid neutralising capacity
AHD	Australian Height Datum
AQM	Air quality management
ARI	Average recurrence interval
ASRIS	Australian Soil Resource Information System
ASS	Acid sulfate soils
bgl	Below ground level
CALD	Culturally and linguistically diverse
CASS	Coastal acid sulfate soils
CCTV	Closed circuit television
CEMP	Construction Environmental Management Plan

Term	Definition
CPTED	Crime prevention through environmental design
CHMP	Cultural Heritage Management Plan
CNVMP	Construction Noise and Vibration Monitoring Plan
CRG	Community Reference Group
CSEMP	Community and Stakeholder Engagement Management Plan
dB	Decibels
DDA	Disability Discrimination Act 1992
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DEPI	Department of Environment and Primary Industry
DELWP	Department of Environment, Land, Water and Planning
EE Act	Environment Effects Act 1978
EES	Environment Effects Statement
EMF	Environmental Management Framework
EMS	Environmental Management System
EP Act	Environment Protection Act 1970
EPA	Environment Protection Authority Victoria
EPR	Environmental Performance Requirement
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
eVDV	Estimated Vibration Dose Value
EVC	Ecological Vegetation Class
GBCA	Green Building Council of Australia
GDE	Groundwater dependent ecosystem
GHG	Greenhouse gas
HERMES	Heritage Management Electronic System
Hha	Habitat hectare
HO	Heritage overlay
IPCC	Intergovernmental Panel on Climate Change
IS	Infrastructure Sustainability

Term	Definition
ISCA	Infrastructure Sustainability Council of Australia
IWRG	Industrial Waste Resource Guidelines
JV	Joint Venture
km	Kilometres
KRA	Key result area
LCZ	Landscape character zone
LGA	Local government area
LSIO	Land Subject to Inundation
LXRA	Level Crossing Removal Authority
LXRP	Level Crossing Removal Program
M11	Mornington Peninsula Freeway
m	Metres
MNES	Matters of National Environmental Significance
MTM	Metro Trains Melbourne
MTPF Act	Major Transport Project Facilitation Act 2009
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
NTU	Nephelometric turbidity unit
PAA	Project Alliance Agreement
PASS	Potential acid sulfate soils
PBC	Polychlorinated Biphenyls
PFAS	Polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PIW	Prescribed industrial waste
PRINP	Passenger Rail Infrastructure Noise Policy
PTV	Public Transport Victoria
PUZ	Public use zone

Term	Definition
Q&A	Question and answer
RACV	Royal Automobile Club of Victoria
SBO	Special Building Overlay
SEPP	State Environment Protection Policy
SLG	Stakeholder Liaison Group
SUP	Shared Use Path
TDS	Total dissolved solids
TI Act	Transport Integration Act 2010
TMP	Traffic Management Plan
TRG	Technical Reference Group
TWA	Trade Waste Agreement
UDG	Urban Design Guidelines
VHI	Victorian Heritage Inventory
VHR	Victorian Heritage Register
WSUD	Water sensitive urban design

Glossary

Term	Definition
Acid neutralising capacity	ANC is the measure of a soil's inherent ability to buffer acidity and resist the lowering of the soil pH. This may be provided by dissolution of calcium and/or magnesium carbonates (e.g. shell), cation exchange reactions, and by reaction with the organic and clay fractions. The efficiency of these buffering constituents and activities is further dependent on the type, amount and particle size of these minerals.
Acid sulfate soils	Naturally occurring soils, sediments or organic substrates (e.g. peat) that are formed under water logged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. When oxidised they can generate acidic (aggressive) groundwater.
Action criteria	The measured level of potential plus existing acidity beyond which management action is required if a soil or sediment is to be disturbed. The trigger levels vary for texture categories and the amount of disturbance. The extent of management required will vary with the level of acidity and the volume of the disturbance, among other factors.
Activity area	The area or areas to be used or developed for an activity (such as, Aboriginal cultural heritage).
Actual acid sulfate soils	Acid sulfate soils that have been disturbed and oxygenated and where some or all the sulfides originally present have been oxidised, resulting in a pH of <4.
Actual acidity	Actual acidity represents soluble and exchangeable acidity already present in the soil and is the acidity often formed as a consequence of previous oxidation of sulfides. This acidity will be mobilised and discharged following a rainfall event and measured by titratable actual acidity.
Aeolian	Geology deposited or formed by wind, as loess or dunes.
Alignment	The geometric layout of a road or railway line in plan (horizontal) and elevation (vertical).
Amenity	The overall quality of the built form and natural environment affecting the level of human enjoyment. In this assessment amenity includes noise and vibration, dust, odour, reduced visual amenity and changes to traffic conditions.
Aquifer	A geological formation, group of formations or part of a formation, which contains sufficient saturated permeable material to transmit and yield significant quantities of water.
Aquifer system	A body of permeable or relatively permeable materials that functions regionally as a water yielding unit. It comprises two or more permeable units separated by, at least locally, confining units that impede groundwater movement.
Aquitard	A geological formation, group of formations or bed which is saturated but does not allow water to flow freely to a pumping bore. However, aquitards may transmit appreciable amounts of water between adjacent aquifers.
At-grade	A road at ground level, not on an embankment or in a cutting.
Australian Height Datum (AHD)	The datum used for the determination of elevations in Australia. The determination uses a national network of benchmarks and tide gauges, and sets mean sea level as zero elevation.

Term	Definition
Average Recurrence Interval	The average, or expected, value of the periods between exceedances of a given rainfall total.
A-weighted decibel (dB(A))	A unit used to represent the airborne sound pressure level on a logarithmic scale. A-weighting (A) is a frequency filter applied to measured noise to represent how the human ear hears sound. Noise limits applicable to environmental impacts are typically specified in terms of dB(A).
Bedrock	A general term for rock, usually solid, that underlies soil or other unconsolidated material.
Beneficial use	A use of the environment or any element of the environment which is conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges, emissions or deposits.
Biodiversity	The variety of all life-forms, the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part.
Bioregion	A landscape-based approach to classifying the land surface using a range of environmental attributes such as climate, geomorphology, lithology and vegetation.
Bioregional Conservation Status	An assessment of the conservation status of the native vegetation type (EVC) in the context of a particular bioregion, taking account of how commonly it originally occurred, the current level of depletion and the level of degradation of condition typical of remaining stands.
Catchment	The land area that drains into a stream, river, lake, estuary, or coastal zone.
Certificate of Environmental Audit	Issued for a property where, following an audit, an environmental auditor believes the environmental condition of the land is suitable for any beneficial use.
Coastal acid sulfate soils	Acid sulfate soils (ASS) can occur in coastal and inland settings. Where ASS occur in coastal settings they are commonly referred to as coastal acid sulfate soils (CASS).
Community cohesion	The quantity and quality of interactions between community members, the extent to which members of a local community know and care about one another and the extent of attachment to a geographic community or a community of interest.
Community infrastructure	A building that accommodates a range of social, educational and recreational activities, meetings, health and support services.
Concept design	Initial functional layout of a rail/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimating and to determine further investigations needed for detailed design.
Confined aquifer	A formation in which the groundwater is isolated from the atmosphere at the point of discharge by impermeable geologic formations. Confined groundwater is generally subject to pressure greater than atmosphere.
Connectivity	The ability for people to access community and recreation facilities and their daily needs – easily, safely and without being hindered by barriers.
Contaminant	A substance, element, or compound that, if added to soil or an aquifer, has an adverse effect on the quality of water in that aquifer.
Contaminated land	Land used for industry, mining or the storage of chemicals, gas, wastes or liquefied fuels (if not ancillary to another use of land).

Term	Definition
Contaminated soil	Soil or a mixture of soils that can be classified as Category A, B or C contaminated soil as provided for under the Regulations and defined in the Industrial Waste Guidelines (published in Special Gazette No. S177 on 9 June 2009).
Corrosion	The act or process of dissolving or wearing away a material.
Day	Based on the definition in the PRINP, this is the 16-hour period from 6:00 am to 10:00 pm.
Decibel	A unit of measurement used to express the ratio between two values on a logarithmic scale. As the ear perceives sound energy logarithmically, the decibel is the unit used when referring to noise levels.
Decommissioned bore	A bore – the purpose and use of which have been permanently discontinued.
Dewatering	The lowering of static groundwater levels through extraction, usually by means of pumping from one or several groundwater bores.
Discharge	Any process by which water is removed from an aquifer. Includes water that flows to a surface feature, such as a spring, river or wetland, as well as water which flows to an adjacent aquifer.
Dissolved oxygen	The amount of oxygen dissolved in water, such as groundwater or surface water. Usually measured in parts per million.
Dn	Down – train travel away from Melbourne/Flinders Street Station.
Drawdown	The change in groundwater head level that can generally be attributed to the operation of a pumping bore.
Ecological Vegetation Class (EVC)	EVCs are the standard unit for classifying vegetation types in Victoria. EVCs are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating.
Ecology	Ecology is the study of the interrelationships between living organisms and their environments.
Ecosystem	A system that is made up of a community of animals, plants, and bacteria and its interrelated physical and chemical environment.
Environment	Environment is a broad term that includes ecological, cultural, social, heritage, health, safety and economic aspects.
Environmental Performance Requirement	An environmental outcome that must be achieved during design, construction and operation of the projects.
Erosion	The process or group of processes whereby solids in the natural environment are relocated by moving water, glacial ice or wind.
Estimated Vibration Dose Value (eVDV)	A predicted Vibration Dose Value determined from measurement of exposures and vibration levels and applied to a period of time. Used to estimate Vibration Dose Values for residences exposed to multiple events of finite duration (such as passenger train movements).

Term	Definition
Evaporation	The process by which liquid water becomes gaseous, or the volume lost from a body of water due to this process.
Evapotranspiration	Pertains to water lost to the atmosphere via evaporation and transpiration of plants.
Ex situ	A Latin phrase that means 'out of place'. The ex situ investigation refers to soil testing and spoil characterisation once soil is excavated. The ex situ spoil volume refers to volume of excavated soils and includes a bulking factor depending on the soil texture.
Exotic vegetation	Any vegetation that is not native to Australia or its States and Territories. This can sometimes include native species established outside their natural range.
Fault	A fracture or zone of fractures in a geological layer along which there has been displacement of the sides relative to one another.
Groundwater	Water occurring naturally below ground level or water pumped, diverted and released into a bore for storage underground.
Groundwater dependent ecosystems	An ecosystem that requires access to groundwater to meet all or some of its water requirements to maintain the communities of plants and animals and ecological processes it supports, and ecosystem services it provides.
Groundwater monitoring bore	A bore installed with the purpose to; determine the nature and properties of subsurface ground conditions; provide access to groundwater for measuring level, physical and chemical properties; and permit the collection of groundwater samples and conduct of aquifer testing.
Groundwater pumping (production) bore	A bore installed with the primary purpose to extract groundwater from a particular hydrogeological formation by means of a pump.
Habitat hectare	<p>A site-based measure of quality and quantity of native vegetation that is assessed in the context of the relevant native vegetation type.</p> <p>For remnant vegetation:</p> <ul style="list-style-type: none"> Habitat hectares of remnant patch = extent in hectares × condition multiplier. <p>For scattered trees:</p> <ul style="list-style-type: none"> Habitat hectares of scattered trees = (number of trees × standard extent) × condition multiplier. <p>(Where standard extent is a circle with 15 metre radius).</p>
Habitat zone	A discrete area of native vegetation consisting of a single vegetation type (EVC) with an assumed similar averaged quality. This is the base spatial unit for conducting a habitat hectare assessment.
Hardness	A measure of the mineral content of water, primarily calcium and magnesium ions. 'Hard' water causes an insoluble residue to form when water is used with soap.
Headworks	The part of a bore that protrudes at the ground surface. Usually entails a concrete collar and pad around the bore casing raised above the natural surface to prevent surface water entering the bore.
Heritage item	Any place, building or object listed on a statutory heritage register.

Term	Definition
High-threat weed	Introduced species, including native species occurring outside their natural range (non-indigenous), with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term, assuming on-going current site characteristics and disturbance regime.
Hydraulic conductivity	The rate at which water at the prevailing kinematic viscosity would move under a unit hydraulic gradient through a unit area measured perpendicular to the direction of flow, expressed in metres per day.
Hydrogen sulfide	A gas with the formula H_2S . Commonly known as 'rotten egg gas' due to its smell, H_2S is released from anaerobic systems as a metabolic by-product. The gas is heavier than air and potentially fatally toxic if allowed to accumulate in confined spaces.
Hydrogeochemistry	The chemical characteristics of water in hydrogeological formations.
Hydrogeologic	Those factors that deal with subsurface waters and related geologic aspects of surface waters.
Hydrostratigraphy	The identification and distinction of hydrogeological units based on their hydraulic properties.
Igneous rock	Rocks that solidified from molten material, that is, from magma.
Impact pathway	The consequence of an action or hazardous event that results in a change in conditions.
In situ	A Latin phrase that means 'on-site' or 'in place'. The in situ investigation refers to intrusive investigation of soils in place, prior to being excavated. The in situ spoil volume refers to volume of undisturbed soils prior to disturbance.
Indigenous vegetation	Indigenous vegetation includes vegetation that is native to Australia, as well as being native to a specific geographic region.
Intrusive rock	Igneous rocks formed from magma injected beneath the Earth's surface. Generally, these rocks have large crystals caused by slow cooling.
LAeq	The equivalent continuous sound pressure level measured over a specific period (in dB(A)), and is often referred to as the average sound pressure level over time.
LAeq	Equivalent A-weighted continuous sound pressure level. It is the value of the sound pressure level of a continuous steady sound that has the same acoustic energy as a given time-varying sound pressure level when determined over the same measurement time interval. Often referred to as average sound pressure level.
LAeq,16hr	A-weighted equivalent continuous sound pressure level measured over the 16-hour period from 6:00 am to 10:00 pm.
LAeq,8hr	A-weighted equivalent continuous sound pressure level measured over the 8-hour period from 10:00 pm to 6:00 am.
LAm_{ax}	The maximum A-weighted sound pressure level that occurs during a given measurement period.

Term	Definition
Landscape character zones	These are distinct zones of the landscape that are relatively homogenous in character. They are generic in nature in that they may occur in different areas but, wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Leachate	The liquid that has percolated through solid waste and dissolved soluble components.
Lithology	The physical character of a rock or rock formation.
Land subject to inundation overlay	Identification under state planning schemes of land in a flood storage or flood fringe area affected by the 1 in 100-year flood.
Matter of National Environmental Significance	The EPBC Act defines and protects nine MNES: World Heritage properties, National Heritage places, wetlands of international importance (Ramsar sites), listed threatened species and ecological communities, migratory species protected under international agreements (JAMBA, CAMBA, ROKAMBA), Commonwealth marine areas, Great Barrier Reef Marine Park, nuclear actions (including uranium mines), and a water resource, in relation to coal seam gas development and large coal mining development.
Monitoring bore	Refer to 'observation bore'.
Native vegetation	Native vegetation includes all vegetation that is native to Australia, and its States and Territories.
Native vegetation offset	A native vegetation offset is any works or other actions to make reparation for the loss of native vegetation arising from the removal of native vegetation. This may include an area of existing remnant vegetation that is protected and managed, an area that is revegetated and protected, an area that is set aside for regeneration or restoration, or any combination of these. The relative size of an offset is graded according to its conservation significance.
Night	Based on the definition in the PRINP, this is the 8-hour period from 10:00 pm to 6:00 am.
Non-indigenous vegetation or species	Vegetation or species native to Australia, but not to the geographic region within which a site is located.
Nephelometric Turbidity Unit	Unit of measurement for turbidity.
Observation bore	A well drilled in a selected location for observing parameters such as water levels and pressure changes.
Oxidation	Describes the loss of electrons or hydrogen and the gain of oxygen by a molecule, atom or ion, or the increase in oxidation state of an element. The most familiar example of chemical oxidation is rusting iron. In an ASS context, the term is commonly used to refer to the process of pyrite or iron sulfides reacting with oxygen and releasing acid and iron products.
Pedestrian priority route	Priority route for pedestrians in the SmartRoads Road Use Hierarchy.
Permeability	The property or capacity of a porous rock, soil or sediment for transmitting a fluid. It is a measurement of the relative ease of fluid flow within a material.

Term	Definition
pH	A measure of the acidity or alkalinity of a solution. Neutral solutions have a value of 7, this value increases for alkaline solutions and decreases for acidic solutions.
Pile	A pile or piling is a vertical structural element of a deep foundation, driven or drilled deep into the ground.
Pleistocene	Of, relating to, or denoting the first epoch of the Quaternary period, between the Pliocene and Holocene epochs, from 2.5 million years ago to 10,000 years ago.
Polyfluoroalkyl substances	A group of manufactured chemicals called per- and polyfluorinated alkyl substances (PFAS) have historically been used in firefighting foams and other industrial and consumer products for many decades. The two most well-known PFAS are PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid).
Porosity	The percentage of the bulk volume of a soil or rock that is occupied by interstices, whether isolated or connected.
Potential acid sulfate soil	These are soils containing iron sulfides that has not been exposed to air and oxidised but will generate acidity if oxidised.
Potential acidity	Potential acidity is the 'hidden' acidity that will be released if all of the sulfide minerals contained within a soil (e.g. pyrite) are fully oxidised.
Preferred traffic route	The highest degree of priority for traffic in the SmartRoads Road Use Hierarchy.
Priority site	Sites for which EPA Victoria has issued a clean-up notice pursuant to Section 62A, or a pollution abatement notice pursuant to Section 31A or 31B (relevant to land and/or groundwater), of the Environment Protection Act 1970.
Project area	Area of land identified around the projects to which the proposed planning scheme amendment applies.
Project footprint	Area of land within the project area that will be directly affected by construction activity necessary to remove the level crossings and build the associated infrastructure.
Rail movement	A rail movement is the passage of a single train consist within the rail corridor.
Ramsar site	A site protected by the Ramsar Convention, an international treaty on the conservation and wise use of wetlands and their resources.
Receptor	A receptor (also called a sensitive receptor) is a location at which noise or vibration is likely to impact upon a noise or vibration sensitive use. Residential premises are an example of sensitive receptor.
Recharge	The process of adding water, or the amount of water added, to the volume of water stored in an aquifer.
Recreation facility	A building, formal or informal open space (including parks) used for passive recreation or sporting activities.
Remediate	To remove, disperse, destroy, dispose of, abate, neutralise or treat any pollutant, waste, substance or environmental hazard in order to restore the environment to a state as close as practicable to the state it was in immediately before contamination.

Term	Definition
Remnant patch	A continuous area of native vegetation, with or without trees, where less than 75 per cent of the total understorey plant cover is weeds or non-native plants (bare ground not included), or a group (i.e. three or more) of trees where the tree canopy cover is at least 20 per cent. Patches may occur across one or more land tenures and may consist of one or more habitat zones.
Risk rating	A risk rating considers the likelihood and consequence of an event.
Salinity	A measure of the dissolved salt content of water or soil.
Special Building Overlay	Identification under state planning schemes of land in urban areas liable to inundation by overland flows from the urban drainage system.
Scattered tree	Scattered trees are those indigenous canopy trees (greater than five metres in height) within an area where at least 75 per cent of the total understorey plant cover is weeds or non-native plants and the overall canopy cover for a group (i.e. three or more) of trees is less than 20 per cent.
Sedimentary rock	Rocks resulting from the consolidation of loose sediments that has accumulated in layers.
Segment	SEPP (Groundwaters of Victoria) categorises groundwater into five segments, each having a particular beneficial use identified. These are maintenance of ecosystems, potable water supply (desirable and/or acceptable), potable mineral water supply, agriculture, parks and gardens and stock watering.
Semi-confined (or leaky) aquifer	An aquifer confined by a layer of moderate permeability (aquitard) that allows vertical leakage of water into or out of the aquifer.
Sensitive use	A land use (as defined within the Planning and Environment Act 1987) that due to the type of use would be sensitive to either noise or vibration impacts. Residences are considered to be sensitive uses, but other uses (such as heritage structures, public recreation areas or places of worship) may also be considered sensitive.
Shared use path	Shared use paths are areas open to the public that are designated for use by both pedestrians and cyclists.
Site type	Category of Aboriginal cultural heritage place held on the Victorian Aboriginal Heritage Register.
SmartRoads	SmartRoads is an approach that manages competing interests for limited road space by giving priority use of the road to different transport modes at particular times of the day.
Sound power level	The sound power level is used to describe the strength of a noise source.
Spoil hazard classification	Under Victorian legislation, producers of contaminated soil must categorise their spoil into one of four categories: Category A, B, C or clean fill. The categorisation determines the management options (for example reuse or disposal) that are available for that material.
Standing water level or static water level	The level of water in a well or bore that is not being affected by pumping of groundwater.

Term	Definition
Statement of Environmental Audit	Issued where, following an audit, an environmental auditor believes the land is not suitable for all possible beneficial uses, but is suitable for specific uses or developments. It may contain conditions for clean-up or management of contamination.
Static water level or standing water level	The level of water in a well that is not being affected by the withdrawal of groundwater.
Stratigraphy	The study of rock layers and layering, especially of their distribution, deposition and age.
Stratigraphy	The study of rock/soil strata, especially of their distribution, deposition and age.
Sub-artesian	Conditions where groundwater rises naturally in a bore to a height appreciably above that of the surrounding water table, but not flowing out of the bore.
Surface water	Any water that collects as a surface features, including rivers, streams, lakes, wetlands and the ocean.
Tanked structure	Waterproof membrane applied over a surface, preventing completely the entry of liquid water under hydrostatic (water) pressure.
Tertiary age	The term for a geologic period from 65 million to 2.6 million years ago, a time span that lies between the superseded Secondary period and the Quaternary period.
Total count	Total count refers to the total number of birds observed over the monitoring period. It is a tally of all observations and does not account for double count of individuals as the same bird may be present at the time of multiple observations.
Total dissolved solids	The total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water.
Traffic route	Traffic route in the SmartRoads Road Use Hierarchy that receives a lower level of priority than a preferred traffic route.
Transmissivity	The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient.
Unconfined aquifer	An aquifer where the water table is exposed to the atmosphere through openings in the overlying materials.
Up	Up – train travel toward Melbourne/Flinders Street Station.
View	A sight or prospect of some landscape, scene, etc.
Vista	A view or prospect, especially one seen through a long, narrow avenue or passage, as between rows of trees, houses, or the like.
Visual receptor	Individual and/or defined groups of people who have the potential to be visually affected by a proposal.
Water quality	The physical, chemical and biological characteristics of water, frequently used by reference to a set of standards against which compliance can be assessed.

Term	Definition
Water table	The level at which the groundwater pressure is equal to atmospheric pressure. It may be conveniently visualised as the 'surface' of the subsurface materials that are saturated with groundwater in a given vicinity. However, saturated conditions may extend above the water table as surface tension holds water in some pores below atmospheric pressure.
Weathering	The mechanical and chemical breakdown of rocks by the action of rain, snow, wind, etc.
Wetland	An area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others.
Water sensitive urban design	Integrates water cycle management into urban planning to achieve water quality and waterway health outcomes.
Yield	The rate at which water can be extracted from a pumping well, typically measured in L/sec or ML/sec.